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Conceptual Digital Twin Framework for Quality Assurance in the Injection Molding Industry: Technical and Digital Skill Perspectives

For maintaining a competitive edge in the market, companies strive to improve the quality of their products while also minimizing downtime and maintenance costs. One of the ways to achieve this is through Digital Twins (DTs). DTs can serve as a powerful tool for implementing quality assurance (QA) processes. However, current DT-driven QA frameworks do not provide guidelines for addressing the unique challenges of the injection molding industry, which include a highly complex process chain, collaboration and communication silos, and the need for enhanced quality assurance tools. To alleviate these challenges, this paper proposes a DT-driven quality assurance framework for injection molding. The purpose of the framework is to guide manufacturers in how to setup a DT for injection molding quality assurance that meets the QA needs across the mold lifecycle and at the same time can be constructed from meaningful data available in industry and has the required personnel with the digital skills to build, operate and maintain the DT. The framework was developed by the Design Science Research (DSR) methodology in collaboration with a leading Danish injection molding company and DT experts. Overall, we developed a conceptual DT-driven QA framework tailored to the specific requirements of injection molding companies that can help to take full advantage of the DT. Besides the DT framework, this paper makes an academic contribution by outlining the linkage of digital skills and technical requirements of building, using, and maintaining the DT.

Keywords

Digital Twin, quality assurance, injection moulding

Classification

Mainly methodology

Primary authors: BLASCO ROMÁN, Sara (Copenhagen Business School and The LEGO Group); BOETTJER, Till (Aarhus University)

Presenters: BLASCO ROMÁN, Sara (Copenhagen Business School and The LEGO Group); BOETTJER, Till (Aarhus University)

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